TECHNOLOGY ENHANCED LEARNING IN DESIGN AND TECHNOLOGY EDUCATION

By

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ABSTRACT

The focus of this literature review addresses the opportunities which new media can have for design and technology education at university level. Advances on public and technology interaction have changed drastically with the impact of New Media and Information and Communication Technologies (ICTs). This research investigates the role of New Media and Information and Communication Technologies for design and technology education. As more young people participate in a greater variety of new communication modalities, new studies of these forms of communication - and new methods of studying such communication tools- need to be developed. This research will provide unique insights and recommendations for, how new approaches of analysing and understanding New Media and ICTs can enrich the everyday pedagogic practices in design and technology education. In particular, scenarios for New Media applications will be applied to design and technology education. It is argued that the results from this research and literature review will have promising implications for the design of New Media applications appropriate to the educational context they have been researched in.

INTRODUCTION

The topic for this literature review concerns investigating the opportunities that New Media can have for Design and Technology education (D and T education). New Media describes the cultural phenomenon around media applications which can only be viewed with the aid of a computer. Popular examples include MySpace and Skype. After introducing the topic area and background, this research produces some learning scenarios as a backdrop to how new media resources could be used in design and technology university education. Finally, by performing a literature review on the theoretical investigations behind new media and design and technology, it is expected that some pathways to a suitable methodological approach can be followed thus. New Media would not exist without internet technology. In demonstrating the *five principles of New Media* (numerical representation, modularity, automation, variability and transcoding), Manovich (2001) produces some crucial concepts, which, go to the heart of what design and technology is in itself. So for example, modularity in new media would be the components such as pixels, code images and sound. Modularity in design occurs as the designer separates the elements of the design into chunks, e.g. electrical components and polymer casing. The five principles described formulate some of the essential aspects of new media which separate it from old media. The concept of "New media" encompasses the cultural practices which have arisen around Internet technologies, such as online chat rooms, Wikis, blogs, instant messaging, email and software for communication. Using *New Media* for learning ties in with the concept of technology - mediated learning. Technology - mediated learning is defined as any educational content or communication of content done through the use of technology, such as computers, mobile devices (e.g. mobile phones, iPods®) and even virtual reality (Page *et al.*, 2006), and also game - based learning.

The research questions are " what are the opportunities which new media can have for D and T education at university level?, How advances in the public and technology interaction have changed drastically with the impact of New Media and Information and Communication Technology (ICT)?" etc. Therefore, this research investigates the role of New Media and ICT for D and T education. The objective is to investigate how mobile and Information and Communications technologies can be integrated into D and T education research in a stimulating way. As more young people

participate in a greater variety of new communication modalities, new studies of these forms of communication - and new methods of studying such communication tools- need to be developed. This research explores and provides unique insights and recommendations for new approaches of analysing and understanding the ways in which New Media and ICT can enrich the everyday pedagogic practices in D and T education. In particular, learning and teaching scenarios for New Media applications are applied to D and T education. The results from this research and literature review will have promising implications for the design of New Media applications appropriate to the educational context they have been researched in.

Information and Communications Technologies became a widespread means of producing and accessing learning content in University settings with the introduction of desktop computing, server technology and the Internet. So, in the example of server technology, this has given rise to Virtual Learning Servers, which are central repositories for information and learning resources within university work practices. This research encompasses computer and Internet communication technologies such as Wikis, virtual learning environments (VLEs), RSS feeds, and games for learning *as New Media examples*. Table 1 maps the focus of this research.

Who	Researcher, Students
What	The Design, Development and Role that New Media can have in Design and Technology Education
Where	Design and Technology Department, University of Loughborough
Why	There is a current gap in the university utilisation of new media for design and technology education
When	2005 - 2008
How	Identifying learning scenarios which can be applied to Design and Technology Education. Performing an investigation of theory and methodology, and through a combination of research methods, investigate the opportunities which New Media hold for design and technology education.
Current stage of research	Year 2 - Data Collection Implementation of New Media resources on design and technology education

Table 1. The Research Map

This research table details the current stage of research in year 2 of the research. In year 1, quantitative and qualitative data were collected and analysed in the form of questionnaires from design and technology students and interviews from design and technology lecturers. To set the scene, the research gap was established and to gain an overview of the area, literary investigations into theory and method were conducted in relation to this research map.

1.Background

This section forms an investigation of the terms used in this research. The term *New Media* entails certain characteristics such as interactivity, *digitality, virtuality, hypertext,* and *cyberspace* (Lister, 2003). Embedding these concepts into technology - mediated learning means that learning objects have different properties to the traditional ways of imparting information; they may be in many formats, or multimedia. These learning objects may be mobile in the sense that they take advantage of wireless network access (where users can send and receive contextual information in a Wifi "hotspot") and mobile devices, such as iPods®. They may be collaborative in the sense that they will involve the use of "social software". So this might include, for example, the use of photo capabilities on camera phones by design and technology students for assignments as one learning scenario (in section 4).

Universities in the UK have been making technological advancements in terms of mobile learning (Sharples *et al.*, 2002) and computer-mediated learning. The purpose of this research is to investigate new modalities (e.g. mobile/ audio/visual) for accessing new media in a learning context. Thus, future continuation of these threads of learning would involve developing scenarios into prototype learning tools. Thus, the importance of developing workable learning scenarios cannot be under - estimated. As Dumais and Czerwinski (2001) note, there will always be technology-usage scenarios for which the basic research simply does not exist to guide during design. This research will specifically focus on learning scenarios with computer and mobile technology, in the field of D and T education.

The use of mobile technology for learning has become more widespread, as an extension of learning through technology, also known as e-learning or "technology-mediated learning" (Alpion, 2001; Holme & Sharples, 2001). However, more importantly, research is required to identify whether these advancements are a note worthy improvement on established pedagogy. To assess, whether technology mediated learning does or does not improve knowledge and skills, requires study of specific teaching and learning pedagogy in the particular field, with the particular students (Hannafin *et al.,* 2003). The current status of research in this area reveals that universities are in the process of implementation of pilot applications in mobile learning, (Sharples, 2002), virtual learning environments and other Internet based tools. The author emphasizes the importance of establishing a sound pedagogical model for their development pertinent to the particular subject area - in this case of D and T education.

Current tendencies in the area of mobile learning for design and technology education supply the required mobile devices to the students to assess mobile learning (Kimbell, 2005). However, this research seeks to integrate with the students' own mobile device use. In this respect it seeks to develop "ubiquitous learning" (Laroussi, 2001), which means flexible anytime - anywhere learning that integrates with the students own methods, technological prowess and pedagogical context.

2.Features of technology- mediated learning: State of the Art

This section seeks to identify the state of the art in terms of technological capabilities associated with learning and social software. So far, this research has looked at technology - mediated learning which could include mobile technology. The devices used will be:

a) mobile Phones/ PDAs;

b) iPods®/ MP3 player;

c) laptops/ Desktop Computers;

d) software.

The issue regarding New Media as a phenomenon, relates to the fact that it is not the technology, or device, which are the important drivers, for learning but the collaborative contexts and uses which people make of them. In this sense New Media is a general description of the *cultural practices* which have arised around these technologies. A less generic and technological term for the applications which facilitate communication is the term "social software". At this stage, user research needs to be done on developed applications. From the results of user research, further design requirements and implications can be drawn.

Web 2.0 technology is a term coined by Internet entrepreneur Tim O'Reilly, to describe the shift in the practices on the Internet which reflects the growth of New Media technologies. Web 2.0 contains some characteristics of New Media technology, whilst charting the move from the 'old' Internet to the 'new Internet'. Table 2 displays the type of new media technologies with their corresponding examples of "social software".

The way in which information is designed and displayed has a crucial impact on how usable that information is in practice. The Internet has an abundance of design resources available to the design and technology student. Websites such as the IEEE virtual museum and the design & technology online website are some useful resource for the students; small handheld devices such as mobile phones and PDAs are being used to access the Web. What will be the effect for a learner with these different ways of accessing learning objects? Device characteristics, such as screen size, picture/ image resolution, interface design, and the context in which the students will use for learning, all have impact on the user's ability of using the learning environment. Such characteristics need to be considered when designing learning objects for design and technology education.

The aim of this section was to identify some new media applications for use in this research, and issues of usability

A) Chat facilities: MSN, Skype	F) RSS:Bloglines,
B) Photo Sharing: Flickr, SHozu	G) Wikis:Wikipedia
C) Video Sharing: YouTube	H) Games:
D) Meeting Spaces: WAYN, Bebo	I) Mobile Devices: MMS, text Message
E) Blogs: Blogspace	

Table 2. Categories of Social Software

of interfaces, devices and software for learning in D and T education. The state of learning technology at the University of Loughborough is evolving. The University of Loughborough has its own virtual learning environment called learn@lboro server, where students can access learning materials in the design and technology department.

However, it argued that this resource is not being utilised as creatively as it might for design and technology education, due in part to its relative novelty. Thus the scenarios within which these applications can be applied for design and technology education will be explored.

This section will highlight some of the work done in Computer Supported Collaborative Learning (CSCL) in relation to audio visual mediated lectures where the student views the lecture through a screen. This term could cover a variety of technology - mediated learning tools. In particular, the web or audio visual techniques for delivery of lectures has originated from Tutored Video Instruction (TVI). TVI was invented at Stanford University in 1977. In TVI, a small group of students play a pre-recorded videotape of a classroom lecture. Learning differences

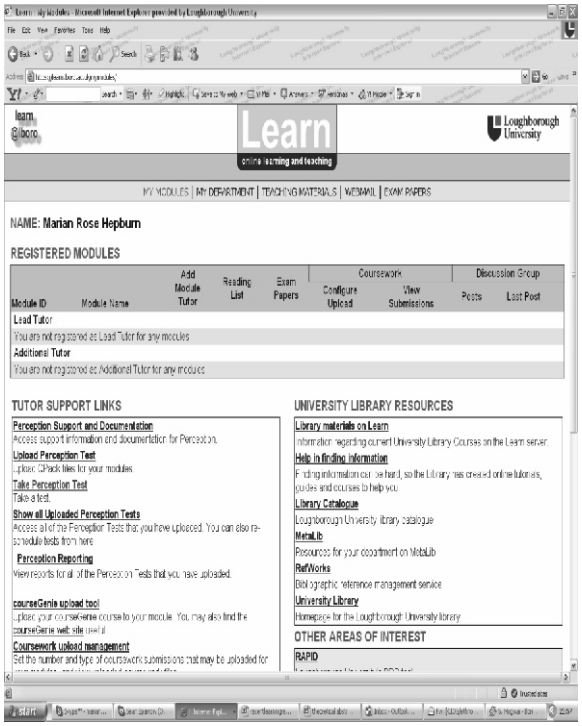

Figure 1. The Learn@lboro Virtual Learning Environment Interface

were not significant between those who watched the video together and those students who were not from the same physical location, also known as Distributed Tutored Video Instruction. During the time of playing, the tape as a facilitator encourages the students to pause the tape to ask questions or discuss topics. In this form of collaborative learning, TVI & DVTI students have shown to outperform students who physically attended the lecture (Gibbons *et. al.,* 1977). An extension of this research in today's web - enhanced education has given rise to *enhanced DTVI* (Sipusic: 1999) This web based application incorporates the feature of shared note taking, whereby students collaboratively take notes as the lecture plays and the notes automatically appear as web pages so that the group members can view the notes later. As the notes are collated and students have a shared task, the outcome is valuable to all of the students; thus collaborative learning can be evaluated more effectively.

The use of interactive video instruction has been adapted for design and technology education to facilitate learning (Hodgson & Norman, 1993). Hodgson & Norman, (1993), identify the usefulness of video as a learning tool and develop a prototype interactive video application for school students. The learning content of the videos illustrates design contexts in such a way to identify design specifications. Discussing the nature of the term "interactive", they identify "planned interactions" which arise from Interactive Video as pedagogical tools for structured learning. However, teacher feedback in this study identified control is an important aspect for the success of this type of technology. The issue of diminished control of the lecturer may be a hindrance to learning, with mobile video blogging. For example, if the lecturer has to focus on facilitating learning through this type of technology, questions may arise as, how to facilitate e.g. turn taking and, clarifying misconstrued meanings.

Oiras *et al.*, (2000), emphasise the power of communication modalities, such as email and bulletin boards, on the development of virtual collaborative distance education environments. This assertion is based on the development of "TelEduc", a virtual distance education environment, developed since 1996,

supporting the delivery of many online courses. This environment has been developed through participatory design, the authors argue that this method has given rise to many social aspects, such as student - motivation, interaction, attitudes and personalities. This has led to development of a final version of TelEduc which has incorporated tools to sustain these social aspects and to assist interaction, thereby improving the educational process.

An example of an implemented tool is the Portfolio, which was a success in terms of collaboration between students. This tool is an individual directory where students upload the results of their work and completed tasks. Each item of Portfolio can be seen by either the individual or by all, depending on how it has been configured. The students liked the tool as it gave rise to the possibility to comment on other Portfolios, to see other students' solutions to problems and to receive teachers comments. They confirmed that this communication/ collaboration - exchange contributed significantly to their learning. Orias *et al*., (2000) note the change in the architecture of learning from teacher- led to student- led learning.

Seng and Hok (2003) discuss the development of the *edveNTUre* system at a Singapore University. This system sought to implement design considerations that aim to "humanise" e-learning, in order to make e-learning collaborative environments people - oriented and thus to make it more interactive and fun. This was through the development of a video talking head that synchronises with the lecture presentation, and a live audio-video and text chat arena used as an on-line collaborative virtual classroom. They also note the gradual change from lecturer-centred to student-centred approaches in the mode of teaching and learning. As a feature of this change, they argue that students should be evaluated on their problem solving skills, rather than on how much material could be memorised and regurgitated. However due to "distance" in distance education, developing a sense of community among students is one of the critical factors in ensuring the success of online learning.

The program technology used to develop the content for the lectures is Macromedia Breeze. Macromedia Breeze is a multimedia content creation tool that converts the conventional Microsoft PowerPoint slides into Macromedia Flash animations. It allows voice narration to be synchronised with PowerPoint slides. It also allows the embedding of an interactive quiz as part of the lecture. The key advantage of this software is that the learning curve is minimal for those who can already use Microsoft PowerPoint. The deliverer of the lecture only needs some training on how to incorporate audio - visual aspects into the lecture. The technology mediated lecture is capable of being used by those with low bandwidth connectivity (i.e. 56k bps modem dial-up). Use of this type of technology would allow the student to receive more interactive material. Recent work by DeRienzo (2000) notes that in on-line learning, interaction is the key factor and passive "lecturing" seems not to work. A key feature of new media is interactivity, and it is argued that learning applications should, also possess this feature.

There has been less success in asynchronous CSCL tools for establishing the sense of immediacy, interactivity, and shared purpose resulting from face-to-face meetings, which are necessary for effective learning scenarios. To overcome this problem Baeker (2003) has developed an internet technology environment, using webcast technology, entitled *ePresence*. Webcasting is the Internet broadcasting of streaming media such as video, so that it can be viewed via a Web browser on a personal computer. Webcasting is scalable to a large number of participants, but is typically a one-way broadcast medium that is not interactive. Baeker attempts to make an effective interactive e-learning environment accessible asynchronously, through integrating webcast technology and other tools such as chat facility. Baeker conducted research on the use of webcasting for the remote attendance of lectures. From the prototype development of ePresence, the author formulated a set of design requirements which the author categorises into Participants Media Interactivity, Archives and System. Once the system was running they implemented it in a lecture with 19 local attendees in the lecture hall and another with 30 remote attendees. The results showed

that almost all viewers liked the ability to interact with other viewers through the integrated chat facility (mimicking a face to face lecture scenario). Out of the remote attendees, only six did not like the experience, citing usability or learning problems with the system. The local attendees were also mostly positive about using the system.

In conclusion to this section, it is possible from this proposed literature to develop some ideas for scenarios where new media technology may be useful in educational contexts. Some constraints and limitations have been identified with the reviewed applications in CSCL. The next section identifies the sorts of scenarios where implementation of new media might be appropriate for D and T education.

3. Learning and Teaching Scenarios

So, to reiterate, the aim of this research is to investigate opportunities which new media possesses for design and technology education. So far, topic definition and usability of technology only have been identified. The next line of inquiry involves using the tool of the scenario to envisage the contexts and effects of students of design and technology education and new media technology. This section investigates some literature on learning scenarios, and identifies six learning scenarios which employ recent advances in technology and media to enhance learning. It should be noted that these scenarios are in some ways not totally distinct from one another, e.g. video lectures in Scenario below could relate to and follow on from video lectures for mobile devices. A literature review on the proposed scenarios has revealed some of the design implications for employing New Media on design and technology modules. Scenarios are classified as;

"a concrete description of an activity that the user engages in when performing a specific task, a description sufficiently detailed so the design implications can be inferred and reasoned about" (Carroll, 1995).

This section identifies some learning scenarios which employ mobile and computer technology. Table 3 provides an overview of proposed learning scenarios which could potentially be researched as new media for technology - mediated education. This scenario research will be concerned with the development and implementation of communication and learning objects within the department of Design and Technology, Loughborough University.

No.	Title
1	Student - Controlled learning: Using Photo capabilities Of Mobile Phone/ Devices for Group Work
2	Lecturer Delivered Learning: Using Audio/ Video capabilities Of Mobile MP3 players for Design and Technology Lectures
3	The Use of Wiki Technology: " Wikinteract "
4	Dynamic Information: RSS for Sustainable Design Research
5	DigiDT : Using blogging for assessments

Table 3. Scenario Identification for Design and Technology Education

3.1 Scenario 1. Student - Controlled learning: Using Photo/ Video capabilities Of Mobile Devices for Group Work

This section will identify possible scenarios for use of the photo/ video capabilities of mobile devices for design and technology assessed module group work. The first proposal scenario would use the available Multimedia Message Service (MMS) now inherent on many mobile phones as part of technology- mediated learning. For example, the students have a group work to hand in for a module. As part of their portfolio they can use *video capabilities of their mobile device*, using their mobile phone to record themselves explaining a problem in designing while it is on the move. They can then send this to their workspace on the learn server at Loughborough. This could contribute to their overall final grade by demonstrating their ability to think about design while in a variety of different contexts. Using *mobile video blogs* for design projects involves using the students own device for MMS that can be sent to the learning server. A major advantage is that it makes use of the context aware nature of mobile technology. A number of ways of accessing and collating the video content on the learn server could create more of a virtual design portfolio, useful for employment.

A variation of this scenario, as part of their assessment, is the students of design and technology are broken into groups where they have to complete group work on the design of an artifact. In particular they have to comment on the usability, the aesthetic look and feel and the hardware/software constraints of that artifact. The student can use their own mobile device to take *photographs* of artifacts with their mobile device. This occurs whilst the student is on the move, and perhaps not co-located with other members of the group. These photos are sent to everyone, and a copy is uploaded to the server to form part of the group portfolio. This scenario allows students to comment on a design they like and then share it with others. This could occur through the photo sharing applications such as Flickr and Shozu described in Table 1, or an in house version of the photo sharing application could exist on the Learn@lboro server. A variation of this scenario could involve the student simply using their mobile device to take photos of any designs they like or flaws in designs that they use. Categories the students could focus on could be "Aesthetic Look and feel" and "Usability". For example, they could video record/ take photos of their friends' kettle which did not turn off properly and comment on why that might be, or why they did not like that particular design.

The learning outcomes involved in using their image recording facilities of their mobile device for D and T education are identified as the ability to look at an objects design with a critical eye, then record the users use of that object. The benefits to the student include the ability to obtain the information about the design in the context of its use, while the student was "on the move". It is hoped that this would give the learner a sense of design requirements wherever they are, thus developing sharper observational skills.

3.2 Scenario 2. Lecturer Delivered Learning: Using Audio/ Video capabilities Of Mobile MP3 players for Design and Technology Lectures

New forms of mobile devices have given rise to portable audio visual digital media. In particular, Apple Computing PLC made a product called iPod®. This has given rise to the "Podcast" which is a file that can be downloaded for ones' compatible mobile device. This scenario aims to "Podcasts" of lectures on the learning server that can be accessed through the students' own mobile device, iPod or PDA. This has given rise to a new term "iPedagogy", in a school project funded by Apple, using mostly audio delivery. Devices of this nature have come on to the market which support video files.

This scenario involves online video of workshop activities within the department, which can be accessed from the learn@lboro server for students with special grounds for missing essential classes, with a link to the website sent via text to the students' mobile. The use case for this is very similar to use case of the scenario above except with video. There is substantial literature on using video learning resources which will be investigated.

The same learning outcomes that were identified in the previous scenario may also be applicable here. However, this scenario also has benefits in terms of accessibility to the students, those "on the move" and those, perhaps, with disabilities. The existence of information in many different formats has a positive learning outcome; it may be useful to have audio visual representation of lecture material for those with learning disabilities or visual impairment.

3.3 Scenario 3. The Use of Wiki Technology: "Wikinteract"

Wikis were invented as a type of website that allow users to add remove, and edit online content. A well known example is "Wikipedia", an online encyclopaedia. Wikis differ from discussion boards, forums and weblogs as they allow the editing of entries. So thus, in the example, of Wikipedia, a body of knowledge can be changed as a topic and thus be edited to reflect that change, whereas, in blogs and discussion forums the information is permanent and static.

The use of wiki technology has already proved as an useful technology mediated tool for designers. Brereton *et al.,* (2003) combine the use of wiki technology with a video game to assist IT students to develop sharper observation skills that will assist them with the design process. The Video Card Game is similar to a virtual card

game, where the students have to develop themes of user interaction from video analysis. Students then post their interaction themes onto a wiki website. The authors found that the cards, game, role playing and collaboration involved in this method gave rise to more interaction and discussion between student groups and between students and the teaching team, than in previous traditional teaching methods. It took a little time on the part of the lecturers, and the quality of the resulting interaction themes suggests that this method gives rise to students' development of observational skills.

A wiki-web is a type of website that anyone can edit or add content using a normal web-browser. This particular wiki has been designed using perl cgi-scripts running on a webserver (which handle the display and editing of wiki-pages), and a MySQL database to store the text of the pages. The video clips were attainable to the students from their network drive on their computers with a link from the wiki to the video files. The students really liked this tool but there are three ways it could have been made better:

1. First, creating new pages is too difficult. This involved;
   (a) Editing the text of the theme summaries page
   (b) Creating a link to the (still non-existent) new page
   (c) Saving the changes and going back to the theme summaries index page
   (d) Clicking the special link for the new page
   (E)Entering the text for the new page and saving it to the wiki website.
2. The second problem with the wiki technology was that two or more students could not concurrently edit wiki-pages.
3. The final problem identified was that it wasn't possible to rename pages.

This scenario proposes the implementation of a WIKI for students who collaborate in teams on design projects within the department of design and technology. This would involve the simple setting up of a website which could be accessed via the students own mobile device or laptop using Wireless Access Protocol (WAP) at the students own discretion. The benefits of a WIKI for learning are, it offers facilities for more collaboration and communication; plus implications for the students own skills in knowledge retrieval and communication.

3.4 Scenario 4. Dynamic Information: RSS for Sustainable Design Research

Really Simple Syndication, or RSS- a relatively new media- is a way of retrieving information from the Internet; by supplementing or *syndicating* websites with an RSS feed, information can arrive on a particular topic of interest of the user. The purpose of this section is to discuss the ways in which RSS technology can be used for learning. The implementation of RSS is proposed for the "sustainable design" module, department of design and technology, Loughborough University. The reason this module was chosen refers to a concern by the lecturer of this module in interviews conducted on new media learning scenarios. One of the issues which the lecturers identified as a crucial aspect of the use of Internet technologies for/ by students on this module is that they have problems with students citing sources which are not reputable for their assignments. This led to the question, 'whether the implementation of RSS could lead to the provision of more Internet resources vetted by the lecturers themselves?'.

As Harssch (2003) notes RSS has the potential to be the next "killer app" (sic killer application) for education, in so far as it does not assume or require technological capabilities of the user. It saves the user from having to retrieve the content manually from the websites by forwarding the relevant RSS feed to the users email or mobile device. Blekas *et al.,* (2006) describe how RSS can help with the content adaptation of websites through mobile browsers. An RSS feed supplies up- to- date information on the latest news in a particular area or topic. Cold (2006) has noted the usefulness of this tool to enhance the research methods of students, but few implementations of RSS exist to collaborate with these assertions. Thus it is proposed to embed RSS into the sustainable design module.

How will this be done in practice?

- The user signs up to a RSS feed aggregator; a program which collates all RSS information.

- The user subscribes to RSS directories on sustainable design which would give many different feeds or the user subscribes manually to each individual feed on a sustainable design website.
- The user receives up-to-date information on sustainable design.

This scenario will be useful for students so that they can include relevant resources which will assist them in their coursework. This information will be short in the form of headlines so the learner can more easily filter out the articles which may not be relevant. Because of the nature of RSS, the student can remain up to date with the latest developments, for example in the field of sustainable design; very important for those wishing to make a career out of design and technology.

3.5 Scenario 5. DigiDT: Using blogging for assessment

The term blogging refers to a type of website which resembles a computerised journal/ diary which works in reverse chronological order. Blogs can be public or private, and there are various types:

This scenario proposes to use mobile devices for moblogging as part of a collation of work for a portfolio. However difficulties exist at this stage with tying in a moblog or normal blog into the assessment process due to lack of adequate software provision on learn@lboro server. This problem is noted by other JISC funded groups attempting to use blogs, specifically moblogs for education.

"At some stage the reflective blogs will need to be related to their learning environments". Trafford, P. (2005), The Remote Authoring of Mobile Blogs for Learning Environments Project.

The proposal for relating the blogs to their learning environments has been proposed in the form of personal portfolio. The learning outcomes of using a blog would be more stimulating than a paper design log with the capacity for containing multimedia.

Media Type	Devices
Vlogs - Video logs/ Phlogs - photologs	moblog - by mobile device
Linklog - a blog of links	

To conclude, the scenarios present some promising applications of new media for design and technology education. This research adopts an innovative approach to the design and technology education through learning scenarios. It is innovative in two senses. Firstly it seeks to use new media and mobile technology to generate and stimulate learners' ideas for design and technology. As one author notes, (Kimbell: 2005), there has been too much emphasis on the role of Information and Communications Technology in education on "doing and recording activities; to control, to simulate , to manufacture."(p.6). Secondly, this research seeks to extend learning methodology to stimulate students ideas and describes how technology could contribute to learning by designing learning objects from learning scenarios. These learning objects fall within the wider definition of learning objects provided by IEEE . The IEEE Learning Object Metadata standard defines a learning object as "any entity, digital or non-digital, that may be used for learning, education or training". In assessing which scenario to implement previous literature will address previous studies on theoretical and methodological advancements in this area.

4.Methodological Discussion for New Media and D and T Education

This section performs a brief theoretical and methodological investigation for the application of new media resources for D and T education. In particular, it is argued that the collaborative nature of these new media resources provides a new way of looking at the psychology of learning design and technology with these learning resources. As Clark (2003) notes traditional education and training has paid little attention to the psychology of learning and most of the current methods of delivery still rely on "a supply-led, lecture and classroom-based model that flies in the face of the theory" (Clark, 2003, p.45).

Theory on the nature of technology sees it as an instrumental tool, adopted due to the cultural practices which emerge in society. In acting as a tool, technology

mediates learning. Baudrillard is known for his analyses of modes of mediation, and technological communication. And so, to use Baudrillard's work as a tool for analyses, the abundance of information present with New Media, and the causal effect of the dissolution of meaning, express itself in the term "hyper - reality".

Questions arise for the researcher as, 'how to gather evidence for scientific method of assessing?', 'how we learn through new media, without imposing artificial categories and controls?'. There are other practical problems with this the scientific/ empirical method; it has been argued that the scientific method; "help[s] distance theory from action: the stripping of context from actions, dissociation of meaning from purpose, inapplicability of general data to individual cases, and exclusion of the discovery dimension in inquiry" (Hearn & Foth, 2004: p.3).

The authors have thus advocated the use of action research in the design of new media resources and ICT applications to overcome this problem. Action research in not being part of the researcher/ researched dichotomy. In this sense, this parallels with "emancipatory" action research. Habermas (1974) provides a methodological basis for this research framework. Emancipatory action research is not so much a researching-of a community in the traditional "researcher as expert" model, but a researching-with paradigm in which mutual expertises are acknowledged by all research participants. It has been noted that this abandonment of the researcher as expert and participation of the researcher, leads the researcher to collect data in a manner that is akin to the ethnographic method (Baskerville and Pries-Heje: 1999).

Action research orientates towards change in a particular context (this is also argued in the work of Baskerville & Pries-Heje; 1999). This, as information systems and new media implementations in organisations, can be driven for change within organisational settings. The historical development of action research has had 'change' as its goal, since it was first used by Lewin (1947). Popular methods have been used today to map out action research in a five phase, cyclical process (Susman & Evered, 1978). The method first creates a client-system infrastructure or research environment. Then, five identifiable phases are iterated:

(1) diagnosing,

(2) action planning,

(3) action taking,

(4) evaluating and

(5) specifying learning.

It is argued that this plan misses the essential humanistic approach which focuses on the users. But who are the users of the learning system/ objects? What do we mean by users? Users have been viewed as people who interact with a product to achieve some task or goal, e.g. watch TV to relax. This notion of users has widened to include the notion of stakeholders, in more of an action research framework. The stakeholders in the development of learning objects could include the mobile network operators, the ISPs, the University of Loughborough, and widely the future businesses who will employ future graduates who may use mobile technology such as PDAs to deliver work information.

Conclusion and Future Directions

The implementation of RSS on a Sustainable Design module is the next step in this research. The way in which this will be done is to collect user research on how the student would use an RSS aggregator for their student research on sustainable design; whether they can use it, whether it is suitable for that purpose and any unexpected occurrences or breakdowns they experience when trying to use this application. In conclusion to this literature review, the future of this research will involve data collection methods, such as usability studies, quantitative data collection, qualitative interviews, and action research in the form of implementation of *New Media* and technology - mediated learning. It has been argued that;

"the field of new media must be analysed at individual, institutional and cultural levels. Multiple research approaches must therefore be used to make sense of the questions that arise. In this regard, action research can also be taught of as a meta-process for managing inquiry and action on any issue"(Hearn & Foth, 2004: p.3).

Thus this research seeks answer to the question, 'what are the opportunities that exist with new media for design and technology education?'. Potential scenarios have been devised, and corresponding research into each of these scenarios has in some cases revealed some useful design implications for the implementation of teaching and learning applications. The theoretical investigations have paved way for future discussions on the methodologies and methods suitable for implementation of new media learning resources for design and technology education. It is hoped that further studies can stimulate student and lecturers contexts of use of new media learning resources and enhance the everyday pedagogic practices in design and technology education.

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